

**TRANSMISSION CORPORATION OF ANDHRA PRADESH LIMITED**

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From:  
**Chief General Manager/HRD & Planning**  
APTRANSCO,  
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To  
**The Secretary,**  
A.P.E.R.C.,  
11-4-660, 4<sup>th</sup> floor,  
Singareni Bhavan, Red Hills,  
Lakdi-ka-pool, Hyderabad -4

**Lr.No.CGM/HRD&Plg/SE/Plg/EE/RAC&Reforms/APERC/D. No 121/2019, Dt. 10.12.2019.**

Sir,

Sub: APTRANSCO – Regulation 4 of 2017 for forecasting, Scheduling & Deviation Settlement of Solar and Wind generators - Issuing of suitable Amendments to Regulation by APERC - Requested – Reg.

Ref: - Regulation 4 of 2017 issued by Hon'ble APERC

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It is to submit that, Chief Engineer/APSLDC has informed that during implementation of the Regulation 4 of 2017 issued by APERC for forecasting, Scheduling & Deviation Settlement of Solar and Wind generators which is effective from 1.7.2018 for levying and collection of Deviation charges from Qualified Co-ordinating Agencies (QCAs), certain observations were noticed in adopting the clauses viz.2.1(a),2.1(j),4.1,6.3 & 2.1(aa) in day to day operation of grid with the mix of VRE generation & conventional generation and of the view to amend the above clauses. A detailed Report was prepared by APSLDC consolidating the difficulties faced by them in day to day operation of grid.

In order to overcome the aforementioned challenges faced by APSLDC in real-time operations, I am directed to submit the detailed report as approved by CMD/APTransco and as received from APSLDC on the above issues for appraising the same to Hon'ble Commission and for issuing a suitable amendments to the regulation clauses for ensuring the integrated grid operations and for achieving the maximum economy and efficiency in the operation of power system in Andhra Pradesh.

**Encl:** Detailed Report

Yours faithfully,

*[Handwritten Signature]*  
10.12.19

**Chief General Manager/HRD & Planning**



## DETAILED REPORT

The Hon'ble Andhra Pradesh Electricity Regulatory Commission (APERC) during August, 2017, had passed the Regulation No.4 of 2017 on Forecasting, Scheduling and Deviation Settlement of Wind & Solar Generation in 2017 and are effective from 21.08.2017 subject to levy and collection of deviation charges with effect from 1.7.2018. Presently, Solar & Wind Generation forecasting and scheduling for wind and solar generators are being done by Qualified Co-ordinating Agencies (QCAs) and deviation settlements are carried out as per terms of said Regulation 4 of 2017. The QCAs namely, STATKRAFT, MANIKARAN, RE-CONNECT, etc are engaged by Solar & Wind Generators for submitting forecast & schedules to the SLDC.

2. At present AP Grid system is operated in the range of 5300MW to 10170 MW on real time basis with the mix of RE Generation of installed capacity of 7500MW. It is to submit that forecast of generation on day ahead basis has become a challenging task to APSLDC because of the following factors:

- (i) huge mix of inconsistent of VRE Generation;
- (ii) intra day changes in the VRE forecasts
- (iii) wide variations in the day ahead forecast and the actual realisation of VRE
- (iv) long durations for cold/warm starts for the thermal plants
- (v) unavailability of intra day power due to sudden variability of VRE

The system is to be operated in a reliable and economical manner. The Deviation Charges of over injection and under injection of RE generators were fixed by Hon'ble APERC. Prior to the addition of large scale of VRE, Variable Renewable Energy (wind & solar) integration in AP Grid, there were negligible uncertainties in the operation of Grid. But with large scale VRE integration, the system planning has become almost impossible and system operator is forced to handle several uncertainties from the resources including conventional generation. The uncertainties of VRE is affecting the reliability of the conventional generators as well.



3. Normally Power Planning is carried out on day ahead basis to meet grid demand for the next day. It is observed that there were several instances of large variations in VRE generation during the course of day, in absolute terms ranging from 50MW to 2000 MW (over injection or under injection), between Forecast & actual generation. Discoms cannot arrange such quantum of power at short notice and are forced to either give load relief or purchase power at exorbitant prices during intra day market operations. No power market mechanism is also available to get power at short notices. In this scenario, SLDC purely depends upon over drawl from grid resulting in receiving violation notices from SRLDC to adhere to the IEGC Regulations, 2010, amended from time to time.

4. Load relief is becoming inevitable in order to abide by the instructions of SRLDC and as a result we are witnessing uproar among the public. Such instances occurred in June, 19 & September, 2019 and it became issue/point for discussion in State Legislative Assembly. Therefore, it is essential that the Forecast of VRE generation by QCAs matches with actuals. At present the regulations allow wide deviations from the forecast without any liability on part of the either QCA or the VRE Generators. Hence, the allowable deviation need to be narrowed down and deviation settlement charges levied for deviation are to be raised to make the generators more responsible for effective functioning of the grid.

5. The Objective of Regulation 4 of 2017 on Forecasting, scheduling and deviation settlement of solar and wind generation is to maintain grid discipline and grid security as envisaged under the Grid Code through commercial mechanism for Deviation Settlement. However, the said objective of the regulations are not realized as the utilities are facing difficulties with uncertainty in VRE generation. Against this backdrop, APERC is requested to amend certain provisions in the Regulation 4 of 2017. The required amendments together with justification for such amendments are stated hereunder:

**Amendment 1.** The clause 2.1 (a) of APERC's Regulation 4 of 2017 reads, "*Absolute Error*" means the absolute value of the error in the actual injection of wind or

*solar generators with reference to the scheduled generation and the Available Capacity (AVC), as calculated using the following formula for each 15 minute time block*

$$\text{Absolute Error (\%)} = 100 \times (\text{Actual Injection} - \text{Scheduled Generation}) / \text{AVC}$$

Amendment proposed:

Substitute the term 'absolute error' with 'forecast error'.

Substitute the term 'Available Capacity' with 'Scheduled Generation' for calculating Forecast error as per following formula.

$$\text{Forecast Error (\%)} = 100 \times (\text{Schedule Generation} - \text{actual Injection}) / \text{Scheduled Generation.}$$

Justification

- The formula for error should invariably contain one of the two parameters in the numerator as well as in the denominator.
- The absolute error defined in the Regulation contains an unrelated parameter in the denominator.
- Grid requirements are planned duly taking into account of the forecast/schedules from RE generation on day ahead basis which will be taken into account together with other sources.
- Any deviation of such forecast in VRE generation is burden to the utility. By dividing the deviation with available capacity as stated in present regulations, the error becomes infinitesimal and the regulation becomes redundant or toothless.
- Further, since the RE generation never reaches of its maximum capacity i.e., available capacity, the denominator should be replaced with scheduled generation.
- Therefore amendment to definition 'Absolute Error' is necessary in the interest of justice



**Amendment 2.** The clause 2.1(j) of Regulation 4 of 2017 reads, "*deviation in a time block for a seller means its total actual injection minus its total scheduled generation.*"

Amendment proposed:

The definition of phrase 'Allowable forecast error' in percentage should be considered for inclusion.

'Allowable forecast error' =  $100 \times (\text{diversity factor } 0.7 \text{ in control area in the beginning of financial year}) \times (\text{quantum of deviation limit permitted under CERC's DSM Regulation amended from time to time}) / (\text{quantum of VRE installed capacity})$

Justification

- The Hon'ble CERC allows a deviation limit of only  $\pm 250$  MW for RE Rich States.
- For VRE capacity of 7500 MW in the state of AP, forecast error of 15% will result in 1125 MW deviation which is not allowed by CERC.
- The deviation in positive direction results in backing down of conventional generation and violation notices are served by SRLDC on SLDC to adhere to IEGC Regulations while taking corrective steps for maintaining load-generation balance. Deviation in negative direction results in deficit conditions which require resources to bridge the gap between load and generation.
- The deviation of maximum allowable quantum of 1125 MW variation in downward direction will result in over drawl from grid beyond the permissible limits and in that event it would lead to load shedding in real time operation of grid since spinning reserves are not available from conventional sources.
- To overcome this, it is proposed to introduce allowable forecast error to maintain & handle the AP grid system in real time operation.
- For example for installed VRE capacity of 7300MW in the State of AP, considering the diversity factor as 0.7 and 250 MWs deviation limit permitted under CERC's Regulations, the allowable forecast error will be 4.89% or say 5%.

- The deviation settlement charges will not be levied below the allowable forecast error.
- Therefore it is proposed to introduce Allowable forecast error in the Regulation.

**Amendment 3.** The clause 4.1 of Regulation 4 of 2017 reads Quote: *"The Methodology for day-ahead scheduling of wind and solar Energy generating stations which are connected to the Grid and rescheduling them on one and half hourly basis and the methodology of handling deviations of such wind and solar energy generating stations shall be as stated here under and accordingly forecasting tools shall be provided by the generator concerned."*

Amendment proposed:

It is proposed to remove the option of rescheduling of forecast on one and half hourly basis during the day of operation and strictly adhere to scheduling on day ahead basis

Justification

- The objective of bringing this Regulation is to maintain grid discipline and grid security as envisaged under the grid code through commercial mechanism for deviation settlement.
- Discoms have to plan the resources for meeting the demand on day ahead basis. The resources include all conventional and RE Generators. Accordingly Discoms optimise the purchase and sell power through Power Exchanges.
- The deviation in forecast results in deficit or surplus power condition. Under deficit condition there will be deviation in drawl and Discoms have to pay high price for the power that is required to bridge the gap by availing high cost URS power or purchasing power at high cost from the exchanges during the course of the day.
- That apart SLDC would suffer with violation notices by SRLDC, forcing Discoms to resort to load shedding in case the above desired action is not realised.

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- That apart SLDC would suffer with violation notices by SRLDC, forcing Discoms to resort to load shedding in case the above desired action is not realised.



- Such load shedding turns contrary to the policy mandate given by Govt. to maintain 24x7 power supply to all categories of consumers.
- The forecasting and scheduling Tool of VRE generators must be effective to mitigate the power shortage as well as back down of generation. As per Regulations on F & S, the generation from day ahead schedule of VRE power generation gives the quantum of variable energy for assessing the conventional energy requirements on day ahead basis.
- The day ahead schedule of VRE generators is crucial for any grid management which is deciding the quantum of power allocation from other sources. If day ahead forecast & scheduling is accurate in respect of VRE generators, there will not be any power shortage and it would mitigate the backdown instructions.
- SLDC is required to have accurate day ahead schedule from each wind & solar generator to avoid any variation of capacity allocation from other sources or to avoid compulsory load shedding.
- QCAs are submitting forecast and schedules on day ahead and intra day revision. Discoms are planning their availability to meet the grid demand on day ahead basis and tie up power accordingly. Discoms are not able to cope up with the deficit/surplus arising due to variation in VRE Generation in real time operation because of the following reasons
  - (1) Power market mechanism is not mature
  - (2) Warm and cold start-up which will take longer time to reach full load
  - (3) Discoms have to tie up power subject to availability from all sources.

Hence, APDiscoms invariably resort to load shedding with a view to adhere to the IEGC Regulations.

**Amendment 4.** As per the provision 6.3 of Regulation 4 of 2017, the deviation charges for over or under injection for sale/supply of power within the State are tabulated here under:

<i>S.No</i>	<i>Absolute Error in the 15 min. time block</i>	<i>Deviation charges payable to State Pool Account</i>
<i>1</i>	<i>&lt;= 15%</i>	<i>None</i>



2	>15 but <=25%	At Rs.0.50 per unit for the shortfall or excess energy for absolute error beyond 15% and upto 25%
3	>25% but <=35%	At Rs.0.50 per unit for the shortfall or excess energy for absolute error beyond 15% and upto 25% + Rs.1 per unit for balance energy beyond 25% and upto 35%
4	>35%	At Rs.0.50 per unit for the shortfall or excess energy for absolute error beyond 15% and upto 25% + Rs.1 per unit for balance energy beyond 25% and upto 35% + Rs.1.50 per unit for balance energy beyond 35%

Amendment proposed:

The levy and collection of DSM charges should be amended as shown in the table given below:

S.No	Forecast Error in the 15 min. time block	Deviation charges payable to State Pool Account
1	< Allowable Forecast Error	None
2	<ul style="list-style-type: none"> <li>Above Allowable forecast error</li> </ul>	At Rs.2.00 per unit for the shortfall or excess injection

Justification

- With regard to VRE Generation, during the real time operation of Grid, huge variation occurs between the forecast schedules and actual generation. Due to error in forecast of RE Generation, Discoms are resorting to purchase high cost power from power exchange.

- On Many occasions, Discoms have purchased at the rate of 660 paise per unit. That means, Discoms are incurring Rs.2 per unit more than the average VRE power purchase cost.
- Even in that eventuality, sufficient power is not available at that point of time. Hence, Discoms have to go for load relief which has deleterious effect on State GDP. Considering an Energy elasticity of GDP of 0.8, this translates to crores of rupees in losses to the State GDP.
- Another aspect of difficulty in this regard is if the actual VRE generation is more than the forecast, conventional generation has to be backdown which has associated costs to be borne by the Discom. The following are associated costs involved in over injection which comes to Rs.2 per unit

Adequacy costs   Rs.1.60 per unit

Balancing costs   Rs. 0.40 per unit

The adequacy costs of 1.60 paise per unit is derived by considering the difference between VRE costs and weighted average pooled variable cost. The balancing costs of 0.40 per unit arrived at considering the deterioration of station heat rate, increased oil consumption, and excluding wear & tear of the equipment when thermal stations are required frequently backed down,.

**Amendment 5.** *The clause 2.1 (aa) of Regulation 4 of 2017 reads, "Virtual Pool means the virtual grouping of various pooling stations wherein the generators in such pooling stations have an option for accounting their deviational in an aggregated / combined manner through a QCA for the purpose of availing the benefit of larger geographical area and diversity."*

*Amendment proposed:*

*The definition phrase of virtual pooling may be considered to be deleted from definition 2.1 (aa) and also be deleted at clause 6.9 of Regulation 4 of 2017.*



### Justification

- As per Regulation 2.1(aa), All the schedules and actuals of generators are aggregated while calculating the DSM. This Provision is not available in any State which were framed by respective Regulatory Commissions.
- Indiscipline to grid caused by few generators is shared and spread over to among all generators in the virtual pool.

6. All the above issues have surfaced during implementation of provisions of Regulation 4 of 2017. The said issues are being encountered by the grid operator in real time operation of grid. It is, therefore, requested to amend the several clauses stated above in the Regulation 4 of 2017, in public interest.